Having thus described the preferred embodiment, we now claim:

1.   In a color output system, a method of rendering a color document with a multi-level halftone process using a single screen for a plurality of color separations

5   wherein the screen is comprised of a plurality of pixel locations associated with successive threshold values, the method comprising rendering at least one of the color separations at a pixel location with a selected output value from allowed output levels, said selected output value being determined by an input color value for the separation at the pixel location, a maximum output value allowed, the halftone screen, and input color values of previously

10   processed separations.

2.   The method as defined in claim 1 wherein the rendering of the at least one color separation is at pixel locations having threshold values successive to the threshold values of the previously printed colorants.

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3.   The method as defined in claim 2 wherein the color image includes a black separation which is rendered first.

4.   The method as defined in claim 3 wherein the rendering of a non black

20   separation outputs a requested color amount in a non black area using a plurality of output levels comprising a darker and a lighter output levels and wherein, the darker output level occupies lowest available threshold values of the screen at a highest luminance in a non black area, and the lighter output level occupies other available threshold values of the screen in the non black area adjacent to the darker output level.

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5.   The method as defined in claim 1 wherein the color separations comprise Black, Magenta, Cyan and Yellow, and the method comprises printing the Black separation with a bi-level process and at least one of the Magenta, Cyan and Yellow separations with a multi-level process.

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6.   The method as defined in claim 5 wherein the printing of the at least one of the separations with a multi-level process comprises selecting a pixel location for the printing in accordance with a filling algorithm including a multiple level factor and a successive filling factor for better dispersion and minimal overlap of drops.

7.   The method as described in claim 6 wherein the multi-level process comprises using multiple colorant drops at each pixel location.

8.   The method as defined in claim 7 further comprising printing a plurality of ink drops per pixel location for multiple level halftoning of the one color separation after filling of the pixel locations to a base level.

9.   The method as defined in claim 8 wherein the printing of the plurality of ink drops for the one color separation comprises successively filling the pixel locations in accordance with increasing threshold values.

10.   A method of rendering a contone image with CMYK halftone separations denoted $i_C(m,n)$, $i_M(m,n)$, $i_Y(m,n)$, and $i_K(m,n)$, respectively, by multiple level halftoning using a single halftone screen represented by $h(m,n)$ comprising steps of

Screening the K separation to get a binary K output $b_K(m,n)$ as:

If $(i_K(m,n) > h(m,n))$ $b_K(m,n) = 1$, otherwise $b_K(m,n) = 0$.

If $b_K(m,n) = 0\{$

Processing the M separation:

Computing:

A base level of M as $l_M(m,n) = \lfloor (i_M(m,n) * NM/(255 - i_K(m,n)) \rfloor$,

A remaining M value as $d_M(m,n) = i_M(m,n) * NM - l_M(m,n) * (255 - i_K(m,n))$

Limiting: $l_M(m,n) = min(l_M(m,n), NM)$

if $(l_M(m,n) >= NM)$ $d_M(m,n) = 0$

Determining an output M value:

If $((h(m,n) > i_K(m,n))$ & $(h(m,n) < i_K(m,n) + d_M(m,n)))$ $b_M(m,n) = l_M(m,n) + 1$

else $b_M(m,n) = l_M(m,n)$

Processing the C separation:

Computing:

A base level of C as $l_C(m,n) = \lfloor (i_C(m,n) * NC/(255- i_K(m,n)))\rfloor$

A remaining C value as $d_C(m,n) = i_C(m,n) *NC - l_C(m,n) *(255- i_K(m,n))$

Limiting: $l_C(m,n) = min(l_C(m,n), NC)$

if $(l_C(m,n)>=NC)$ $d_C(m,n)=0$

Determining an output C value:

$b_C(m,n)=l_C(m,n)$ (Default value – potentially modified below)

If $((d_M(m,n)+ d_C(m,n)<(255 - i_K(m,n)))\{$

If $((h(m,n)> i_K(m,n)) + d_M(m,n)) $ & $(h(m,n)<= i_K(m,n)+ d_M(m,n)+$ $d_C(m,n)))$ $b_C(m,n) = l_C(m,n)+1\}$

else   if $(h(m,n) (255- d_C(m,n)))$ $b_C(m,n)= l_C(m,n)+1$, and

Halftoning the Y separation using an independent screen $h_Y(m,n)$:

If $(i_Y(m,n)> h_Y(m,n))$ $b_Y(m,n)=1$, otherwise $b_Y(m,n)=0$

11.   The method as described in claim 10 wherein the independent screen for the Y separation is the "conjugate" of the screen used for other separations given by

$h_Y(m,n) = 255-h(m,n)$

12.   A method for printing a color contone image with a plurality of color separations using color dots selectively comprised of a plurality of ink drops of one or more colorants, comprising:

printing at least one of the colorants with the plurality of ink drops at pixel locations identified by a screen, wherein a base level comprising a minimal application of the ink drops, is maximally dispersed at selected ones of the pixel locations defined by threshold values of the screen, and any remaining value comprising a supplemental application of the ink drops, is likewise successively assigned to the selected ones of the pixel locations: and,

wherein the selected ones of the pixel locations are further defined as successive to other pixel locations of the screen previously assigned to a prior printed colorant.

13.   The method as defined in claim 12 wherein when all pixel locations have been assigned the supplemental application of the ink drops, subsequently applied colorants are assigned to pixel locations defined as having a lightest value relative to Black and the lowest thresholds of the screen with said lightest value

14.   A rendering apparatus for a color image represented in a halftone process by a plurality of color separations, comprising:

a halftoning screen generator for producing a screen having threshold values at pixel locations, wherein the values can be applied to contone image signals to derive a binary or multiple level image signal suitable to drive the apparatus; and,

a processor for rendering the color separations in accordance with the screen, wherein for constant image separation values, pixel locations are turned on for base and remaining level values of a color separation at the pixel locations disposed in a highest available luminance region having a lowest available threshold value.

15.   The apparatus as claimed in claim 14 wherein the processor renders a black separation first and other color separations thereafter, and wherein one of the other color separation comprises a printing of multiple ink drops at lowest available threshold values of the screen at a highest luminance in a non black rendered area of the screen, and a printing of a single ink drop at other available threshold values of the screen in the non black rendered area adjacent to the multiple ink drops printing.